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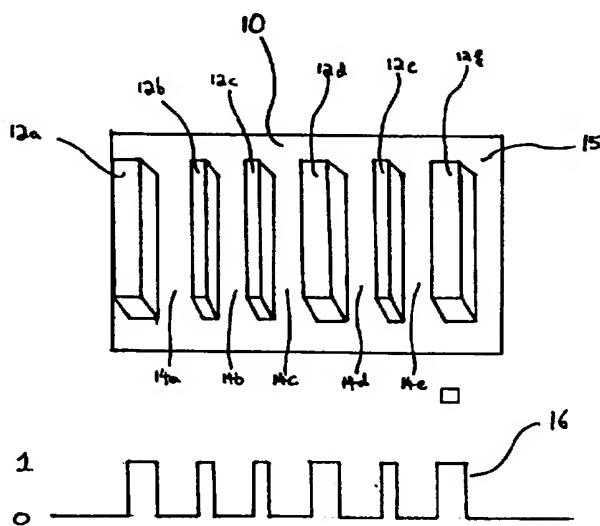
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(72) Inventor(s) George Stylios	(56) Documents Cited GB 2276476 A GB 2196767 A GB 2154775 A GB 2031199 A GB 1580735 A EP 0240078 A1 US 4625101 A
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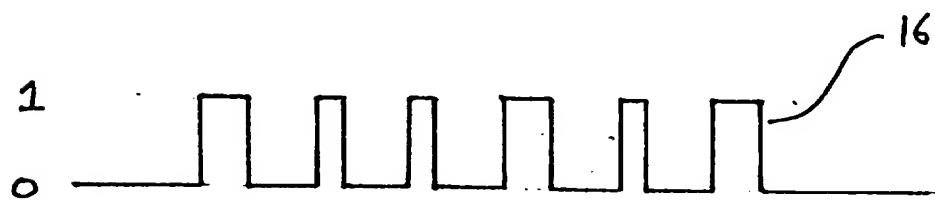
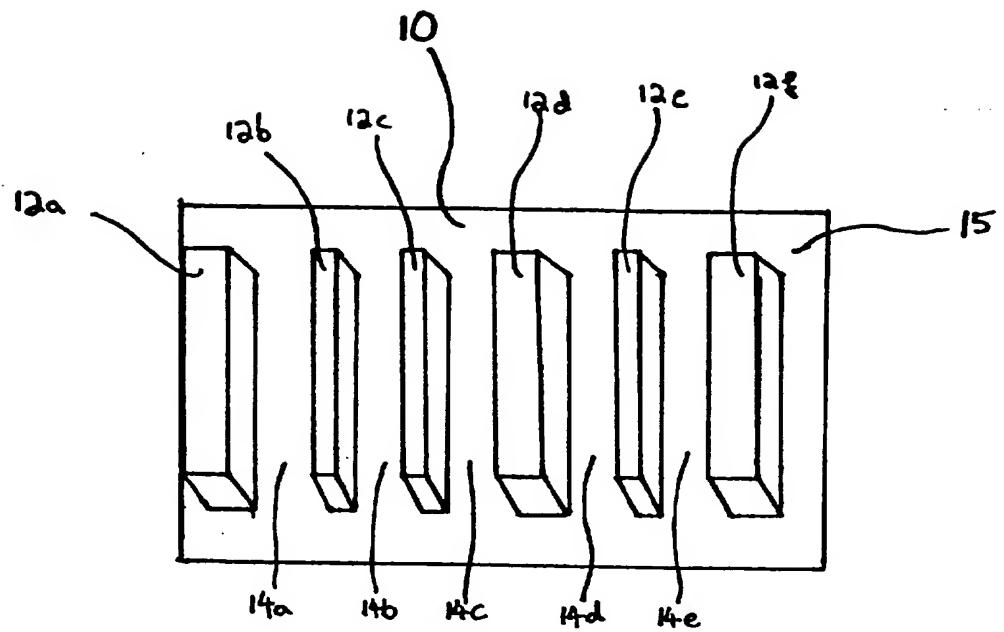
(54) Bar codes

(57) A three dimensional (3D) bar coding system comprises: (a) a 3D bar code having bars that are raised with respect to a substrate surface and are of variable width and/or height, (b) a bar code reader having detection means for detecting the widths and/or heights of the raised bars and (c) decoder means for converting said widths and/or heights into a descriptor e.g identifying number.

The 3D bar code may be produced by printing, embossing, engraving, weaving, knitting, embroidery, screen printing, or stamping.



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BAR CODES

This invention relates to bar codes.

The use of bar codes as a means of identifying products and indicating price, stock, etc is becoming increasingly widespread. Conventional bar code systems are based upon the recognition and interpretation of colour intensity differences. Usually black and white bars are employed, producing a square wave code, the amplitude of which is scaled to correspond to either binary 0 or 1.

The conventional approach relies upon the contrast between the dark and light regions, and therefore is susceptible to contamination by colourants such as chemicals, dyestuffs or liquids. As a result, it is not possible to employ conventional bar codes during the manufacture and processing of many products, especially when wet processing is involved. Rather, a bar code would be applied to the finished article. However, the bar coding of components and partially fabricated products is desirable, since it would permit tracing of these items throughout the production process.

The present invention addresses the aforementioned issues.

According to the invention there is provided a three dimensional (3D) bar coding system comprising :

a 3D bar code having bars that are raised with respect to a substrate surface and are of variable width and/or height;

a bar code reader having detection means for detecting the widths and/or heights of the raised bars; and

decoder means for converting said widths and/or heights into a descriptor.

The 3D bar code may be produced by printing, embossing, engraving, weaving, embroidery, screen printing, or stamping.

The width of a bar may be one of two values.

The height of a bar may be one of two values.

The bar code reader may convert the output of the detector means into square wave format, and this may be achieved by thresholding.

The detection means may be a charge coupled device (CCD) or a displacement sensor, and either device may employ a laser or an array of light emitting diodes (LEDs) for illumination purposes.

The detection means may be an ultrasonic distance sensor.

The decoder means may be integral with the bar code reader or separate therefrom

Bar coding systems in accordance with the present invention will now be described with reference to the accompanying drawing which shows a bar code of the present invention and the associated square wave code.

The Figure depicts a 3D bar code 10 having variable width bars 12a, 12b, 12c, 12d, 12e, 12f separated by spaces 14a, 14b, 14c, 14d, 14e and which are raised relative to a substrate surface 15.

The 3D bar code 10 may be produced by printing; embossing, engraving, weaving, embroidery, screen printing, stamping or any suitable means of creating raised areas. Depending on the precise method employed, the bars may be applied to a substrate surface or a surface may be deformed to create the bars.

The width of a bar in Figure 1 may be one of two values : 'thick' or 'thin'. This approach is closely allied to some of the commonly employed conventional bar code methodologies, such as Interleaved 2/5 code wherein each 'character' contains five elements, two of which are always 'thick'. Indeed any conventional bar coding methodology may be employed in the present invention.

The invention further comprises a bar code reader having detection means for detecting the widths of the raised bars, and decoder means for converting said widths into a descriptor, which, of course, is typically a number.

The detection means may be any device capable of a) distinguishing the raised bars from the spaces between the bars, and b) distinguishing between bars of different widths. Examples of suitable devices are ultrasonic distance meters, CCD devices and displacement sensors. The latter is understood to comprise distance measuring devices of the type that direct a beam of light onto an object, and monitor the diffuse reflected light from the object by detecting its position on the sensing area of a position sensitive detector. This position varies as a function of the distance of the object from the detector. The light source may be a laser or an array of LEDs.

The CCD device may be of the type commonly employed to read conventional bar codes, wherein the bar code is illuminated by a light source such as a laser or an array of LEDs and bar code image thus formed is projected onto a CCD. Distortations of the light line permit identification of the bar pattern from the output of the CCD.

The analogue output of such devices is conveniently converted into a square wave code 16 having binary amplitude 0 or 1 by the setting of suitable thresholds.

The decoder means converts the square wave code into its associated descriptor, usually an identifying number. As mentioned above, any of the methodologies commonly employed in conventional two dimensional bar coding may be employed for this purpose. The decoder may be integral with the bar code reader or situated external thereto.

Conventional bar code systems rely upon a substantial contrast between bars and spaces - usually they are black and white, respectively. The advantage of the present invention is that such a contrast is not required, and therefore uniformly coloured bar codes can be read. One application of the present invention lies in the tracking and logging of partially fabricated products and components thereof during the manufacturing process. The invention is particularly applicable if wet processing, involving, for example, coloured chemicals, dyestuffs, liquids is involved, since these conditions preclude the use of conventional bar code systems. The present invention may also have application to finished products that have a tendency to become dirty and thereby obscure conventional bar codes. Notwithstanding these comments, it is also possible to employ a 3D bar code having "black on white" bar-space contrast. Such a 3D bar code could be read by conventional bar code readers.

It will be appreciated that it is not intended to limit the invention to the above examples only, many variations, such as might readily occur to one skilled in the art, being possible without departing from the scope thereof. For instance, whilst the coding described above has been in relation to the widths of the bars, it is possible to utilise the widths of the spaces for the same purpose. Indeed, it is possible to base the coding upon both the widths of the bars and the widths of the spaces. Further, it is possible to vary the heights of the bars - perhaps providing 'high' or 'low' bars. Such an approach may be used instead of, or in conjunction with, variation of the bar widths and space widths.

CLAIMS

1. A three dimensional (3D) bar coding system comprising:
 - a 3D bar code having variable width bars that are raised with respect to a substrate and are of variable width and/or height;
 - a bar code reader having detection means for detecting the widths and/or heights of the raised bars; and
 - decoder means for converting said widths and/or heights into a descriptor.
2. A 3D bar coding system according to claim 1 in which the bar code is produced by printing, embossing, engraving, weaving, knitting, embroidery, screen printing or stamping.
3. A 3D bar coding system according to claim 1 or claim 2 in which the width of a bar takes one of two values.
4. A 3D bar coding system according to any one of the previous claims in which the height of a bar takes one of two values
5. A 3D bar coding according to any of the previous claims in which the bar code reader converts the output of the detector means into square wave format.

6. A 3D bar coding system according to claim 5 in which the conversion into square wave format comprises thresholding.
7. A 3D bar coding system according to any of the previous claims in which the detection means comprises a charge coupled device (CCD).
8. A 3D bar coding system according to an one of claims 1 to 6 in which the detection means comprises a displacement sensor.
9. A 3D bar coding system according to claim 7 or claim 8 in which a laser is employed for illumination purposes.
10. A 3D bar coding system according to claim 7 or claim 8 in which an array of light emitting diodes is employed for illumination purposes.
11. A 3D bar coding system according to any one of claims 1 to 6 in which the detection means is an ultrasonic distance sensor.
12. A 3D bar coding system according to any one of the previous claims in which the decoder means is integral with the bar code reader.
13. A 3D bar coding system according to any one claims 1 to 11 in which the decoder means is situated external to the bar code reader.

14. A three dimensional (3D) data matrix system comprising:
 - a 3D data matrix having variable width squares that are raised with respect to a substrate and are of variable width and/or height.
 - a data matrix reader having detection means for detecting the widths and/or heights of the raised squares; and
 - decoder means for converting said widths and/or heights into a descriptor.
15. A 3D bar coding system according to claim 1 in which the square code is produced by printing, embossing, engraving, weaving, knitting, embroidery, screen printing or stamping.
16. A 3D data matrix system according to any one of claims 3 to 13 in which the said bar code is a data matrix (square code).



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Application No: GB 9524306.9
Claims searched: 1-16

Examiner: Mike Davis
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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4H (HJ)

Int Cl (Ed.6): G06K

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2276476 A (I HOLLAND)	1-16
X	GB 2196767 A (OWENS-ILLINOIS)	"
X	GB 2154775 A (CAN AND BOTTLE SYSTEMS)	"
X	GB 2031199 A (UNITED GLASS)	"
X	GB 1580735 (EMHART ZURICH)	"
X	EP 0240078 A1 (PHILIPS)	"
X	US 4625101 (HINKS ET AL)	"

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